

REMARKS

Favorable reconsideration is respectfully requested.

The claims are 1 and 3 to 6.

The above amendment is responsive to points set forth in the Official Action.

Firstly, the specification has been arranged substantially per the Examiner's suggestion.

With regard to the objection to the abstract, this has been corrected.

Further, the suggested correction to page 1, line 17 of the specification has been made.

With regard to the objections to the claims on page 5 of the Official Action, the required corrections have been made.

With regard to the rejections under 35 U.S.C. 112, the term "substantially" in "which substantially comprises a high impact polystyrene" has been deleted as unnecessary.

With regard to the rejection of the term "having a reduced viscosity...", the term "reduced" has been deleted as unnecessary.

With regard to the rejection of claims 1 to 4 as indefinite, the manner in which the HDT value is obtained is now recited, based on the specification at page 20, lines 7 to 10.

With regard to the rejection of claims 1 to 6 on the ground of obviousness-type double patenting over claims 17, 39 to 43, 53 and 54 of co-pending application Serial No. 10/476,390 and the similar double patenting rejection of claims 1 to 6 over claims 1 to 24 and 39 of co-pending application Serial No. 11/152,372, there is submitted herewith a Terminal Disclaimer which disclaims the terminal portion of any patent maturing from the present application which extends beyond the expiration date of any patent maturing from said co-pending applications.

Turning to the rejections on prior art:

Claims 1 and 2 have been rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Granzow (U.S. 4,162,278).

Further, claims 3 and 5 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Granzow (U.S. 4,162,278) as applied to claim 1 above, and further in view of Official Notice.

Additionally, claim 4 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Granzow (U.S. 4,162,278) as applied to claim 1 above, and further in view of Honl et al. (DE 19648799, as represented by U.S. 6,124,385).

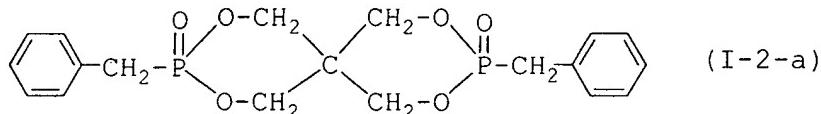
Lastly, claim 6 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Granzow (U.S. 4,162,278) further in view of Honl et al. (DE 19648799, as represented by U.S. 6,124,385) and further in view of Official Notice.

These rejections are respectfully traversed.

Subject matter of the present invention:

The flame retardant resin composition of the present invention comprises the following components (A) and (B) as seen from above-amended claim 1.

- (A) 100 parts by weight of a resin component (component a) which comprises a high impact polystyrene (HIPS); and
- (B) 1 to 50 parts by weight of a phosphorus-containing compound (component b-2) represented by the following formula (I-2-a).



The feature of the resin composition of the present invention is that a molded article of the resin composition has a retention of a heat distortion temperature of at least 95% when the P-compound of the above formula (I-2-a) is selected as a flame retardant for HIPS (component a).

A retention of a heat distortion temperature (to be referred to as "retention of HDT" hereinafter) of at least 95% means that even when the component (b-2) as a flame-retardant is blended with HIPS, the heat distortion temperature (HDT) of HIPS itself rarely lowers.

The further feature of the resin composition of the present invention is that a molded article of the resin composition can achieve at least a flame retardancy level V-2 in UL 94 Standard.

Advantages of the present invention:

Owing to the above feature of the present invention, the V-2 level in UL 94 Standard is achieved by flame retarding HIPS and a high retention of HDT is obtained as well.

This excellent effect of the resin composition of the present invention is obtained by selecting a p-compound of the above formula (I-2-a) having high purity as a flame retardant. When a low-purity P-compound is used, V-2 level and a high retention of HDT cannot be achieved as will be described hereinbelow.

As shown in Examples 12 and 22 of the present invention, the resin composition of the present invention shows V-2 level of flame retardancy and a retention of HDT of 101.1 to 101.5%. Thus, a surprising effect that the retention of HDT is improved by blending a pure P-compound rather than pure HIPS is obtained.

In the present invention, the high-purity P-compound is synthesized in Preparation Example 7. Thus, a P-compound having a purity of 99% is obtained by washing the synthesized crystal compound with water and methanol and filtering it. V-2 level and a high retention of HDT are obtained by using this high-purity P-compound as a flame retardant.

In support of the above features of the present invention, submitted herewith is a Rule 132 Declaration by Katsuhiro Yamanaka, the first named inventor of the present application.

This Declaration shows the following three different phosphonate compounds. Out of these, Sample C is obtained by an Arbuzov-type rearrangement process. Sample C and Sample Z are both phosphate compounds having a pentaerythritol skeleton with a benzyl group at both terminals.

Meanwhile, Sample B is a phosphate compound having a pentaerythritol skeleton with a phenyl group at both terminals. The purities of Samples C, Z and B are as follows:

<u>Sample No.</u>	<u>Purity</u>
Sample C	85%
Sample Z	99%
Sample B	74%

As obvious from the Declaration, when Sample C and Sample B having a low purity are used as flame retardants, the flame retardancy of HIPS does not reach V level and the retention of HDT is low.

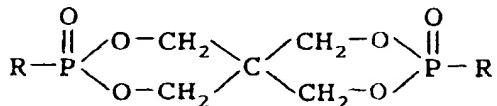
In contrast, when Sample Z having a high purity is used, the flame retardancy of HIPS reaches the V-2 level and the retention of HDT is high.

Turning to the cited references:

Granzow (U.S. 4,162,278) teaches that when a phosphonate compound having a benzyl group at both terminals is used for a polymer consisting of only HIPS, it does not pass the flammability test. It is considered that this is due to the low purity of the phosphonate compound.

It cannot be anticipated from Granzow (U.S. 4,162,278) that V-2 level flame retardancy of HIPS and a high-rention of HDT are achieved by using sample Z (the purity of the phosphonate compound is 99%). The above effect of the present invention cannot be anticipated by or obvious to one of ordinary skill in the art even when the teachings of Granzow (U.S. 4,162,278) are combined with the teaching of Honl et al. (U.S. 6,124,385).

Granzow discloses a flame retardant composition comprising PPE and HIPS. A phosphonate compound of the following formula is used as a flame retardant.



wherein R is methyl, phenyl, benzyl or mono-, di- or trimethyl benzyl.

The resin of Granzow is a mixture of PPE and HIPS. That is, it is a blend of 10 to 90 parts by weight, preferably 20 to 50 parts by weight of PPE and 90 to 10 parts by weight, preferably 80 to 50 parts by weight of HIPS (column 2, lines 14 to 21).

Granzow teaches that a compound (sample C) of the above formula in which R is benzyl is used as a flame retardant and shows in Table 1 that V-1 level is achieved.

What is important here is that a mixture of PPE and HIPS is used as a polymer in Example 1 of Table 1 (the blending ratio of these two is not disclosed).

In Example 3 of Granzow, there is a description of the HIPS flame retarding effect of the phosphonate compound of the above formula. That is, the flame retarding effect of a polymer consisting of HIPS only and not containing PPE is described.

The result of this Example 3 shows that even when a flame retardant is used in an amount of 8 wt%, “none of the compounds of Sample C (R=benzyl), Sample B (R=phenyl) and Sample A (R= methyl) passed the flammability test”.

Thus, Granzow teaches that the phosphonate compound of the above formula does not have an HIPS flame retarding effect.

Meanwhile, Granzow discloses in column 1, lines 66 and 67 that the phosphonate compounds of the above formula can be manufactured by Arbizov-type rearrangement.

The reason why the phosphonate compound of the above formula has no HIPS flame retarding effect in Example 3 of Granzow is assumed to be that the phosphonate compound has low purity.

It is obvious that the composition of Granzow is not a composition comprising a polymer component consisting of HIPS alone and that the subject matter of Granzow is to flame retard a blend of PPE and HIPS.

Honl et al. (U.S. 6,124,385) discloses a thermoplastic molding composition comprising the following components (a) to (e):

- (a) a polyphenylene ether A: 3 to 30 wt%
- (b) impact-modified styrene polymer B; 10 to 65 wt%
- (c) standard styrene polymer C; 30 wt% or more
- (d) free-radical generator D; 0.05 to 5 wt%
- (e) phosphorus-containing flame retardant E; 1 to 20 wt%

In Honl, the polymer component is a blend of PPE and two different styrene polymers (HIPS and standard styrene polymer) and a composition comprising HIPS as the sole polymer component is not included.

A phosphorus compound is used as flame retardant E in Honl, and triphenyl phosphate and triphenyl phosphine oxide are given as examples of the phosphorus compound (see claim 4).

Honl fails to teach a composition which comprises HIPS as the sole polymer component and fails to suggest the use of a compound of the formula (I-2-a) of the present invention as the flame retardant.

Therefore, even if Honl teaches the use of dicumyl compound as the free-radical generator D, the novelty and unobviousness of the present invention are not negated by Honl.

Thus, the rejections on Granzow and Honl in view of secondary references are untenable and should be withdrawn.

Claims 1 and 2 have been rejected under 35 U.S.C. 103(a) as obvious over Axelrod (U.S. 4,520,152).

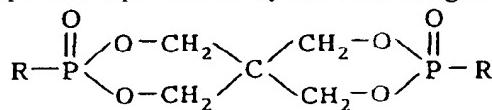
Further, claims 3 and 5 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Axelrod (U.S. 4,520,152) as applied to claim 1 above, and further in view of Official Notice.

Lastly, claim 6 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Axelrod (U.S. 4,520,152) further in view of Honl et al. (DE 19648799, as represented by U.S. 6,124,385) and further in view of Official Notice.

These rejections are respectfully traversed.

Axelrod (U.S. 4,520,152) discloses a flame-retardant composition which comprises the following resin (a) and flame retardant (b):

- (a) a mixture of a polyphenylene ether resin (PPE) and a styrene resin (PS); and
 (b). a P-compound represented by the following formula:



wherein R is an alkyl having 1 to 18 carbon atoms, aryl or alkaryl.

The resin (a) is a mixture containing 20 to 80 parts by weight of PS based on 100 parts by weight of the total of PPE and PS (column 3, lines 15 to 17). Therefore, the resin of D2 is not a resin consisting of only PS.

As for the P-compound (b), Axelrod teaches “R will be methyl, decyl and, especially preferably phenyl”. In the Examples, R is $-\text{CH}_3$, $-\text{C}_{10}\text{H}_2$, or phenyl (see Table in column 4).

Therefore, Axelrod fails to disclose or suggest the use of only PS (HIPS) as a polymer (resin) and use of a P-compound in which R is a benzyl group.

The secondary references do not overcome the deficiencies of Axelrod for reasons set forth above.

For the foregoing reasons, especially taken with the attached Rule 132 Declaration of Yamanaka, it is apparent that the rejections on prior art are untenable and should be withdrawn.

No further issues remaining, allowance of this application is respectfully requested.

Respectfully submitted,

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